6. Optional Capabilities Tests

This section of the Manual explains the tests that must be performed in order for residential ACMs to be approved for optional capabilities. Most of the tests are performed relative to one of the prototype buildings identified in the previous section. Each computer run used to test the minimum space conditioning capabilities is given a precise designation to make it easier to keep track of the runs and to facilitate analysis. Optional capabilities tests begin with the test number "51". The following scheme is used:

12 E 51

Optional capabilities test four

Prototype A is used as the basis of the test

Climate zone 12

6.1 Controlled Ventilation Crawl Spaces (CVC)

Controlled ventilation crawl spaces is an optional capability based on the ability of an ACM to model more than one thermal zone. The crawl space of the building is modeled as a separate, unconditioned thermal zone. Details of the test model are provided in Appendix C, test file 12B51. Some key features are summarized below.

The CVC zone has an exterior perimeter length and floor area (i.e., the ground area) equal to the prototype building B perimeter and floor area. Crawlspace volume is 3467 ft^3. CVC infiltration is modeled using the air changes per hour method and uses 0.22 air changes per hour.

The floor separating the crawl space from conditioned space becomes an interzone boundary. 400 ft2 of this floor has a U-value of 0.342, representing an uninsulated, uncarpeted floor, and the remainder has a U-value of 0.199, representing an uninsulated, carpeted floor.

Insulation is placed in the perimeter walls of the crawl space, and the crawl space vents are modeled with automatic seasonally operated louvers to minimize ambient conditions within the crawl space. When the building is in a heating mode, the vents are closed (inlet and outlet are zero). When the building is in a cooling mode, the vents are open and the total vent area is 1/150 of the crawlspace floor area or 10.67 ft2. Half of this is inlet and half outlet. The ventilation height difference is zero. Only wind effects apply. Wind speed is reduced to 25% of that on the weather tape to account for ground level conditions. Heat capacity in the crawlspace is 1.4 Btu/F-ft2.

When insulation is placed in the perimeter walls of the crawl space in lieu of the floor assembly, other requirements are triggered for builders. The definition of "controlled ventilation crawlspace", in the glossary of the *Residential Manual*, should be consulted for more details.

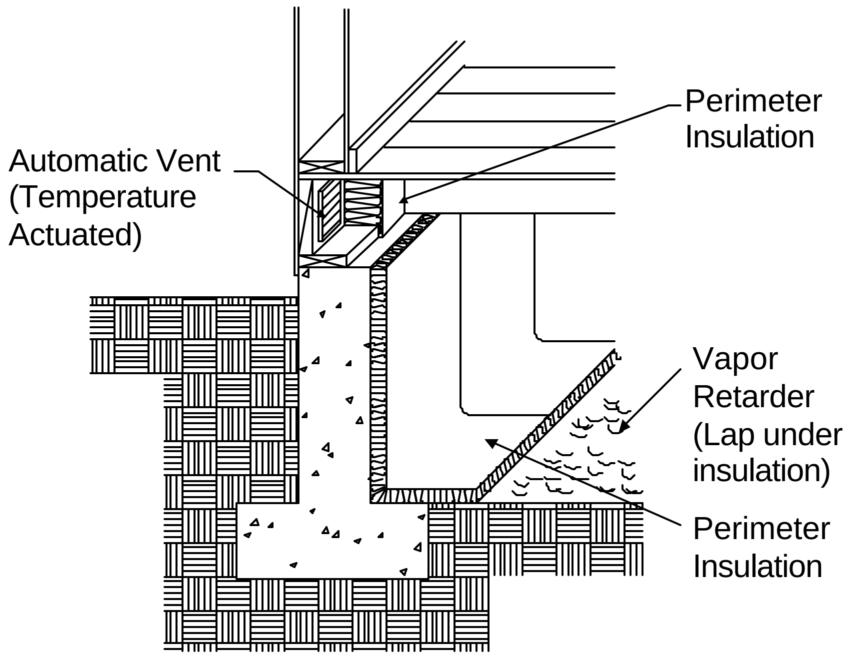

Figure 6-1 - Section at Crawlspace Perimeter

CVC is tested only for prototype building B in five climate zones: 3, 9, 12, 14 and 16. CVC is added and the heating efficiency is modified accordingly. Each computer run must result in greater energy use than the prototype B basecase building. The computer runs are summarized below. *Total of five runs*.

Table 6-1 - Controlled Ventilation Crawlspace Test Inputs

Run Label	CVC	Heating AFUE
03B51	yes	0.63
09B51	yes	0.43
12B51	yes	0.64
14B51	yes	0.69
16B51	yes	0.74

The optional capability test also requires that the vendor demonstrate that the ACM correctly defines the standard design building and calculates the custom budget. This test involves running the standard design equivalent building for climate zone 12 and showing that the custom budget figures from computer run "12B51" are equal. The standard design equivalent building is included in Appendix C and labeled "12B51C".

6.2 Zonal Control

Zonal control is one of the optional capabilities based on the ability of an ACM to model more than one thermal zone at the same time. With zonal control, the sleeping and living areas are modeled separately, each with its own separate thermostat schedule and internal gain assumptions. The specifications for the building with zonal control are detailed in– CALRES~~98~~ input test file 12A52 available from the Commission on diskette. Further discussion is provided in the Residential Manual, in Section 8.9, and in the glossary under "zonal control". Key features are discussed below.

6.2.1 Prototype Zones

~~Figure 1~~ Figure 6-2 depicts the prototype building separated into living and sleeping zones. The boundary between the zones consists of a wall with U-value of 0.29 and net area of 360 square feet. The wall contains an uncloseable opening of 40 square feet, modeled with a U-value of 20.0.

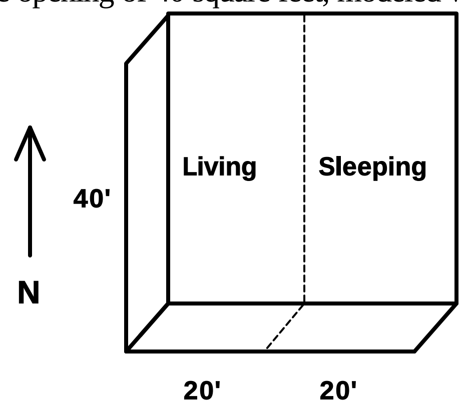

Figure 6-2 - Zoning the Prototype Building

6.2.2 Thermostats

The thermostat schedule for the living area is the same as the standard assumptions except that the cooling setpoint is 83°F between 11:00 pm and 7:00 am.

The thermostat schedule for the sleeping area has two heating setback periods: between 11:00 pm and 7:00 am and between 8:00 am and 9:00 pm. The cooling thermostat has one setup period to 83°F, between 8:00 am and 9:00 pm. The thermostat schedules for zonal control are shown in Table 6-1 below.

Table 6-2 - Zonal Control Thermostat Set Points

Hour	Heating	Cooling	Hour	Heating	Cooling	Hour	Heating	Cooling
Living Areas								
1	60	83	9	68	78	17	68	78
2	60	83	10	68	78	18	68	78
3	60	83	11	68	78	19	68	78
4	60	83	12	68	78	20	68	78
5	60	83	13	68	78	21	68	78
6	60	83	14	68	78	22	68	78
7	60	83	15	68	78	23	68	78
8	68	78	16	68	78	24	60	83
Sleeping Areas								
1	60	78	9	60	83	17	60	83
2	60	78	10	60	83	18	60	83
3	60	78	11	60	83	19	60	83
4	60	78	12	60	83	20	60	83
5	60	78	13	60	83	21	60	83
6	60	78	14	60	83	22	68	78
7	60	78	15	60	83	23	68	78
8	68	83	16	60	83	24	60	78

6.2.3 Internal Gains

Total internal gains are split between the living areas and the sleeping areas as indicated in the following equations.

Equation 6-1

$$\text{Int-Gain}_{living} = (20{,}000) + (15 \times \text{CFA}_{living})$$

Equation 6-2

$$\text{Int-Gain}_{sleeping} = 15 \times \text{CFA}_{sleeping}$$

An alternate set of internal gain schedules are used: one for the living areas of the house and one for the sleeping areas. These alternate schedules are shown in Table 6-3.

Table 6-3 - Internal Gain Schedules for Zonal Control

Hour	Percent	Hour	Percent	Hour	Percent
Living Areas					
1	1.61	9	6.33	17	6.19
2	1.48	10	6.86	18	7.18
3	1.14	11	6.38	19	7.24
4	1.13	12	5.00	20	5.96
5	1.21	13	4.84	21	5.49
6	1.46	14	3.15	22	6.20
7	2.77	15	2.94	23	4.38
8	5.30	16	3.41	24	2.35
Sleeping Areas					
1	4.38	9	3.76	17	4.47
2	4.02	10	3.85	18	4.45
3	4.50	11	4.70	19	4.29
4	4.50	12	3.61	20	3.30
5	4.32	13	3.65	21	3.75
6	5.46	14	2.63	22	3.75
7	6.39	15	2.46	23	4.45
8	7.40	16	2.32	24	3.59

6.2.4 Tests

The zonal control feature is tested only for prototype A in five climate zones: 3, 9, 12, 14 and 16. Zonal control is added and the heating efficiency is modified accordingly. Each computer run must result in greater energy use than prototype A. The computer runs are summarized in Table 6-4 below. *Total of five runs.*

Table 6-4 - Zonal Control Test Inputs

Run Label	Zonal Control	Heating AFUE
03A52	yes	0.74
09A52	yes	0.55
12A52	yes	0.68
14A52	yes	0.68
16A52	yes	0.73

The optional capability test also requires that the vendor demonstrate that the ACM correctly defines the standard design building and calculates the custom budget. This test involves running the standard design equivalent building for climate zone 12 and showing that the custom budget figures from computer run "12A52" are equal. The standard design equivalent building is included in Appendix C and labeled "12A52C".

6.3 Sunspaces

Sunspace modeling is one of the optional capabilities based on the ability of an ACM to model more than one thermal zone at the same time. The sunspace of the building is modeled as a separate, unconditioned thermal zone. The specifications for the test building are detailed in the CALRES~~98~~ input test file 12A53 available from the Commission on diskette, and key features are highlighted below.

An unconditioned sunspace is added to the south side of Prototype A as illustrated in ~~Figures 2 and 3~~Figure 6-3 and Figure 6-4. The wall and window separating the sunspace and the house remains the same as in the base case, but the surfaces and vent openings of this wall are changed from exterior types to interzone types. The interzone vent is controlled to open only when temperature (T) conditions are $T_{house} < T_{desired}$ and $T_{sunspace} > T_{house}$ (in heating mode).

The performance characteristics of sunspace envelope components are the same as for the basecase prototype, except slab F2-value is 0.90; fenestration shading coefficient is 0.90, no internal shading device is assumed. Total vent area is assumed to be 40 ft2 with an eight foot height difference

In the sunspace zone, assumptions for infiltration, heat capacity, –solar gain targeting, and zone thermostat temperature settings vary from the conditioned zone. Sunspace zone infiltration is modeled using the air changes per hour method and the same infiltration factors as used in the 1988 ACM manual, 0.50 air changes per hour. There are no restrictions on targeting solar gains that enter unconditioned spaces such as sunspaces.

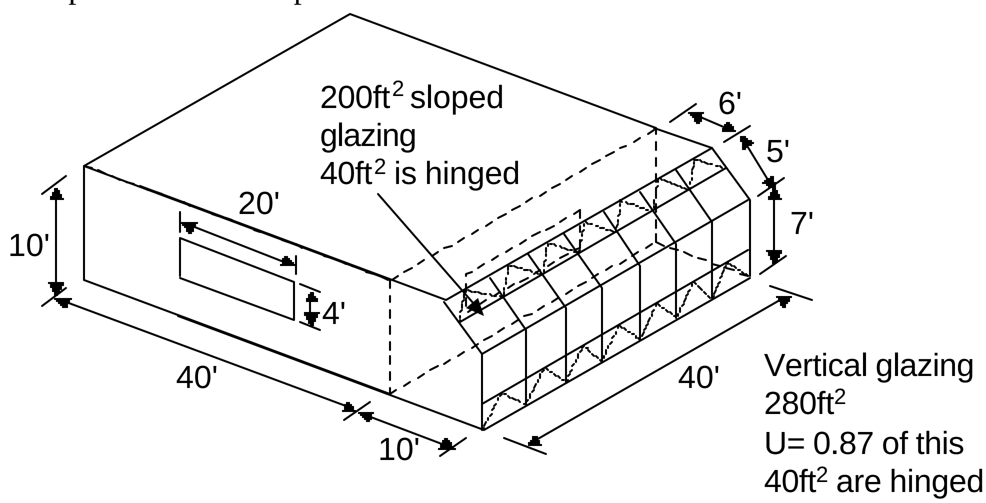

Figure 6-3 -- Sunspace Prototype

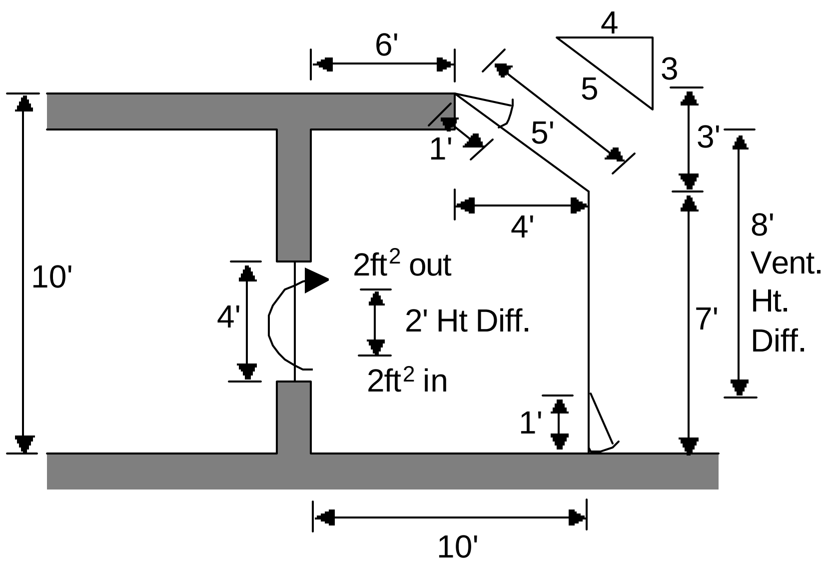

Figure 6-4 - Sunspace Section

Sunspaces are tested only for prototype A in five climate zones: 3, 9, 12, 14 and 16. A sunspace is added and the heating efficiency is modified accordingly. Each computer run must result in greater energy use than prototype A. The computer runs are summarized below. *Total of five runs.*

Table 6-5 – Sunspace Test Inputs

Run Label	Sunspace	Heating AFUE
03A53	Yes	0.55
09A53	Yes	0.29
12A53	Yes	0.54
14A53	Yes	0.54
16A53	Yes	0.64

The optional capability test also requires that the vendor demonstrate that the ACM correctly defines the standard design building and calculates the custom budget. This test involves running the standard design equivalent building for climate zone 12 and showing that the custom budget figures from computer run "12A53" are equal.

6.4 Side Fin Shading

Testing for side fins is performed relative to a modification of prototype A; the base building is rotated 30 degrees to the west. The test is performed in five climate zones: 3, 9, 12, 14 and 16. The specifications for the side fins are provided on the Commission's CALRES~~98~~ input file diskette as , test file 12A54. Key features are covered below.

The side fins extend 40 feet from the surface of a window that is assumed to be 10 feet wide. The fins are 5 feet from the edge of the window. The top of the side fins are 20 feet above the top of the window. Side fins are separately added to the east and west sides of the building and the heating efficiency is modified accordingly. Each computer run must result in greater energy use than prototype A. *Total of five runs.*

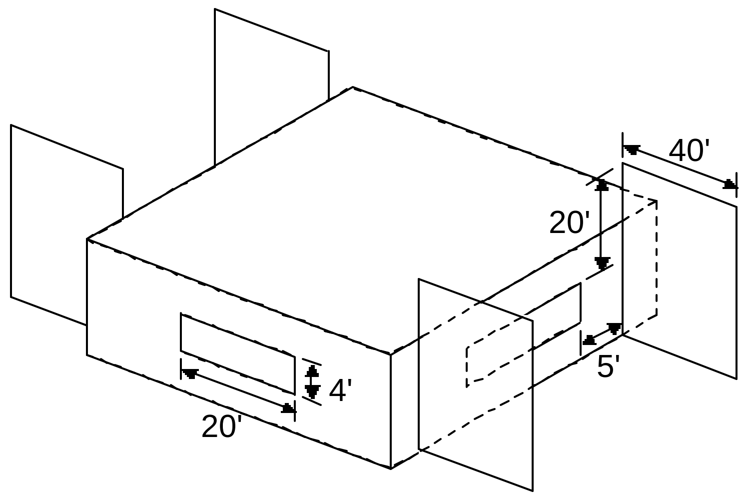

Figure 6-5 - Side Fins for Optional Capabilities Test

Table 6-6 - Side Fin Test Inputs

Run Label	Side Fins	Heating AFUE
03A54	Yes	~~0.87~~0.65
09A54	Yes	~~0.52~~0.40
12A54	Yes	~~0.72~~0.62
14A54	Yes	~~0.76~~0.65
16A54	Yes	~~0.81~~0.70

The optional capability test also requires that the vendor demonstrate that the ACM correctly defines the standard design building and calculates the custom budget. This test involves running the standard design equivalent building for climate zone 12 and showing that the custom budget figures from computer run "12A54" are equal. The standard design equivalent building is included on the CALRES~~98~~ diskette as the input file labeled "12A54C".

6.5 Exterior Mass Walls

The test for exterior mass walls is made relative to prototype A in five climate zones: 3, 9, 12, 14 and 16. All of the exterior walls of the building are assumed to be of mass construction: The mass is assumed to be 12 inches thick with a volumetric heat capacity of 10 Btu/F-cf and a conductivity of 1.064. The outside surface of the mass wall is modeled with a U-value of 2.63 (R = 0.38) to approximate the effect of an air film. Insulation is assumed to be on the inside surface of the wall. This insulation is varied for each climate zone. Each computer run must result in greater energy use than prototype E. *Total of five runs.*

Table 6-7 – Exterior Mass Wall Inputs

Run Label	Exterior Mass Walls	~~Wall U-value~~Interior R-value
03A55	yes	~~0.134~~4.20
09A55	yes	~~0.230~~1.20
12A55	yes	~~0.140~~3.575
14A55	yes	~~0.128~~4.825
16A55	yes	~~0.112~~6.95

The optional capability test also requires that the vendor demonstrate that the ACM correctly defines the standard design building and calculates the custom budget. This test involves running the standard design equivalent building for climate zone 12 and showing that the custom budget figures from computer run "12A55" are equal. The standard design equivalent building is included as the input file labeled "12A55C" on the CALRES~~98~~ input file diskette.

6.6 Optional Water Heating Capabilities Tests

6.6.1 Solar and Wood Stove Boiler Water Heating

Optional water heating capabilities include solar water heating and wood stove boiler-assisted water heating. Energy credit may be taken for the use of these technologies through the use of multipliers that adjust the water heating loads. For solar this adjustment is the Solar Savings Fraction (SSFj) derived from an f-Chart analysis and for wood stove boilers this adjustment is called the Wood Stove Adjustment Factor (WSAFj). These adjustments are used as shown in Section 4.21

6.6.2 Combined Hydronic Space/Water Heating

Combined hydronic space/water heating is a system whereby a water heater is used to provide both space heating and water heating. Hydronic systems or water heaters dedicated solely to space heating are covered in Section 6.6.3.

For combined hydronic systems, an effective AFUE, or for electric water heaters or heat pumps, an effective HSPF, is calculated and used in the space heating energy calculations. When a fan coil is used to distribute heat, the fan energy and the heat contribution of the fan motor must be considered. This shall automatically be added when the distribution type is "ducts". The effective AFUE or HSPF is calculated according to the following equations for each water heater type.

6.6.2.1 Storage Gas Water Heater

When storage gas water heaters are used in combined hydronic applications and there is no air distribution fan, then the effective AFUE is given by the following equation.

Equation 6-3

$$AFUE_{eff} = RE - \frac{PL}{RI}$$

Where

$AFUE_{eff}$ = The effective AFUE of the gas water heater in satisfying the space heating load.

RE = The recovery efficiency of the gas water heater. A default value of 0.76 may be assumed if the recovery efficiency is unknown.

PL = Pipe losses (kBtu/h). This can be assumed to be zero when less than 10 feet of the piping between the water heater storage tank and the fan coil or other heating elements is located in unconditioned space.

Equation 6-4

$$PL = \sum_{i=1}^{n} \frac{FT_i \times PLR_i}{8760}$$

RI = The rated input of the gas water heater (kBtu/h).

When there is an air distribution fan, then the energy used by the fan and the heat contributed by the fan is considered in the same manner as it is for a furnace (see Section 4.18)

6.6.2.2 Storage Electric Water Heater

The HSPF of storage water heaters used for space heating in a combined hydronic system is given by the following equations. If the system has a fan coil, the $HSPF_{eff}$ is used. $HSPF_{w/o\_fan}$ is used if there is no fan coil.

Equation 6-5

$$HSPF_{eff} = \frac{1+.005(3.413)}{\left[\frac{1}{HSPF_{w/o\_fan}}\right]+.005}$$

Equation 6-6

$$HSPF_{w/o\_Fan} = 3.413\left[\frac{1-\frac{PL}{3.413kWi}}{1+\frac{W_{PUMP}}{1000kWiI}}\right]$$

Where:

$HSPF_{eff}$ = The effective HSPF of the electric water heater in satisfying the space heating load.

W_{pump} = The watts of the pump which circulates water between an electric storage water heater and the fan coil

PL = Pipe losses (kBtu/h). This can be assumed to be zero when less than 10 feet of the piping between the water heater storage tank and the fan coil or other heating elements is located in unconditioned space.

kWI = The kilowatts of input to the water heater.

6.6.2.3 Heat Pump Water Heater

The HSPF of heat pump water heaters used for space heating in a combined hydronic system is given by the following equations. If the system has a fan coil, the $HSPF_{eff}$ is used. $HSPF_{w/o\_fan}$ is used if there is no fan coil.

Equation 6-7

$$HSPF_{eff} = \frac{1 + .005(3.413)}{\left[\dfrac{1}{HSPF_{w/o\_fan}}\right] + .005}$$

Equation 6-8

$$HSPF_{w/o\_Fan} = 3.413\left(\frac{RE_{hp}}{CZ_{adj}} - \frac{PL}{3.413kWi}\right)$$

Where:

$HSPF_{eff}$ = The effective HSPF of the heat pump water heater in satisfying the space heating load.

RE_{hp} = The recovery efficiency of the heat pump water heater. The following equation may be used as a default if the recovery efficiency is not known.

Equation 6-9

$$RE_{hp} = \frac{1}{\dfrac{1}{EF_{DOE}} - 0.1175}$$

CZ_{adj} = The climate zone adjustment (see water heating calculation method) (see Table 4-~~11~~9).

PL = Pipe losses (kBtu/h). This can be assumed to be zero when less than 10 feet of the piping between the water heater storage tank and the fan coil or other heating elements is located in unconditioned space.

kWI = The kilowatts of input.

EF_{DOE} = The energy factor of the heat pump water heater when tested according to the DOE test procedure.

6.6.2.4 Pipe Losses

Pipe losses must be considered when pipes between the water heater storage tank and the fan coil or other heating element are located in unconditioned space. To simplify compliance, pipe losses can be ignored when no more than ten feet of pipe (in plan view) is located in unconditioned space[1]. Hourly loss rates are given by the following equation.

Equation 6-10

PL = Hourly pipe loss (kBtu/h).

PLR_i = The annual pipe loss rate per foot of length for the i^{th} pipe (kBtu/y-ft).

FT_i = The length in feet of the i^{th} pipe located within unconditioned space. Can be assumed to be zero if less than ten feet in plan view.

n = The number of unique pipe size or insulation conditions.

The annual pipe loss rate per foot of length (PLRi) is calculated from the following equation

$$PLR_i = 8.76 \left(\frac{T_s - T_a}{\frac{\ln\left(\frac{D_{io}}{D_{po}}\right)}{2\,\pi\,Ki} + \frac{1}{\pi\,ha\,D_{io}}} \right)$$

Where

8.76 = Conversion factor from Btu/hour to kBtu/year

T_s = Supply Temperature. This is assumed to be a constant 135 F.

T_a = Ambient Temperature. This is assumed to be 60.3 in all California climate zones.

D_{io} = Outside diameter of insulation. ft (actual not nominal).

D_{po} = Outside diameter of pipe, ft (actual not nominal).

Ki = Insulation conductivity, constant 0.023 Btu/h-ft-F

ha = Air film coefficient, constant 1.65 Btu/h-ft^2-F

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[1] PL would have a value of about 0.10 for 10 feet of one inch pipe with R-4 insulation, which is required (see page 25 of ACM Approval Manual).

Pipe loss rates (PLR) values for typical conditions are shown in the table below

Table 6-8- Annual Pipe Loss Rates (kBtu/y-ft)

	Insulation Thickness			
Nominal Pipe Size	None	1/2 inch	3/4 inch	1 inch
1/2 inch		71.6	60.9	54.2
3/4 inch		91.1	75.8	66.6
1 inch		109.9	90.1	78.1
1 - 1/2 inch		146.7	117.5	100.3
2 inch		182.9	144.3	121.7

6.6.2.5 Tests

Prototype A is used for this test, but combined hydronic systems are substituted for the gas furnace in the basecase. Three types of combined hydronic systems are tested -- labeled K, L and M.

K A 75 gallon storage gas water heater is used for both space conditioning and water heating. Hot water base boards are used for heat distribution and insulated pipes are located in unconditioned space.

L An electric water heater is used for both space conditioning and water heating and air is distributed through a fan coil system that delivers air to ducts located in an attic.

M An electric heat pump is used for both space conditioning and water heating. Distribution is provided through hot water baseboards. All pipes are located within conditioned space.

The specifications for these three systems are shown in Table 6-9 below. ~~When the combined hydronic system is substituted, the water heating energy and space heating energy must change by an exact ratio from the basecase (see boldface figures below)~~ The AFUEeff and HSPF w/o fan must match the values shown in the table.

Table 6-9 -Combined Hydronic Test Results

		K	L	M
Water Heater Type		SG	SE	HP
Recovery Efficiency	unitless	0.7800	n.a.	n.a.
Rated Input	kBtu/sf	60.0000	n.a.	n.a.
Rated Input	kW	n.a.	5.0000	n.a.
Wpump	W	n.a.	60.0000	n.a.
EF	unitless	n.a.	n.a.	2.0000
~~REhp~~	~~unitless~~	~~n.a.~~	~~n.a.~~	~~2.6144~~
~~CZadj (7)~~	~~unitless~~	~~n.a.~~	~~n.a.~~	~~0.9200~~
Pipe Length	ft	100.0000	n.a.	n.a.
~~PLR~~	~~kBtu/ft-y~~	~~60.9000~~	~~n.a.~~	~~n.a.~~
~~PL~~	~~kBtu/h~~	~~0.6952~~	~~n.a.~~	~~n.a.~~
~~AFUEheat~~	~~unitless~~	~~0.7684~~	~~n.a.~~	~~n.a.~~
~~AFUEeff~~	~~unitless~~	~~0.7519~~	~~n.a.~~	~~n.a.~~
~~DEh~~	~~unitless~~	~~0.8300~~	~~n.a.~~	~~n.a.~~
~~SEE~~	~~unitless~~	~~0.6241~~	~~0.3294~~	~~0.9188~~
~~**Ratio**~~	~~**unitless**~~	~~**1.0145**~~	~~**1.9219**~~	~~**0.6891**~~
~~HSPFw/o_fan~~	~~unitless~~	~~n.a.~~	~~3.3725~~	~~9.6988~~
~~HSPFeff~~	~~unitless~~	~~n.a.~~	~~3.3732~~	~~9.4081~~
Run Label		AFUEeff	HSPF w/o fan	HSPF w/o fan
03A56		0.768	3.37	9.01
09A56		0.768	3.37	9.70
12A56		0.768	3.37	8.34
14A56		0.768	3.37	8.58
16A56		0.768	3.37	5.95

The optional capability test also requires that the vendor demonstrate that the ACM correctly defines the standard design building and calculates the custom budget. This test involves running the standard design equivalent building for climate zone 12 and showing that the custom budget figures from computer run "12A56" are equal. The standard design equivalent building is included in Appendix D and labeled "12A56C".

6.6.3 Dedicated Hydronic Systems

Dedicated hydronic systems have boilers or other heating devices which produce hot water ~~which~~that is distributed through the building for heating. Such systems are permitted when the AFUE is known and can be entered. If the systems have pipes located in unconditioned space, then the AFUE must be adjusted for the pipe losses.

When water heaters are used in hydronic systems for space heating alone (a separate water heater for domestic service), the water heater functions as a boiler and is required by NAECA to have a minimum AFUE of 0.80. The AFUE of a water heater if tested as a boiler would be approximately equal to the average of the EF and the RE, and will generally not meet the minimum NAECA requirement. Water heaters proposed for use in hydronic systems for space heating only must be tested as a boiler using the DOE AFUE and appropriate safety standard test procedures.

6.7 Building Additions

The low-rise residential Building Energy Efficiency Standards permit two ways of analyzing building additions using the performance approach. The addition may be analyzed alone, in which case the internal loads are prorated on a floor area basis. Alternatively, the addition may be analyzed together with the existing house. This second method permits improvements to be made to the existing house which may allow the building addition to have more glass or less insulation.

6.7.1 Addition Alone

When the addition is analyzed alone, the internal loads are prorated on a floor area basis in both the standard design and the proposed design runs. The total internal gain is based on the fractional dwelling unit value, which is used as the "Number-Dwelling-Units" in Equation 4.3 (see Section 4.5). An addition alone may not be modeled as zonal control.

Equation 6-11

$$\text{IntGainAdd} = \text{IntGainTotal} \times \text{FractionalDwellingUnit}$$

$$\text{FractionalDwellingUnit} = \text{CFAadd} \div (\text{CFAadd} + \text{CFAexisting})$$

6.7.2 Addition Plus Existing

When the building addition is analyzed together with the existing building, the procedure described in Chapter 6 of the *Residential Manual*, is followed.

It is necessary to manage information about the existing building and the addition in four categories as described below. These may be grouped in each table or separate C-2R forms may be generated for each category of information.

1 Features of the existing building that will not be upgraded or changed.

2 The current condition of existing building features that will be modified or upgraded.

3 The improved condition of existing building features that are upgraded. The total surface areas in this category will usually be less than those in the second category because an existing wall is usually eliminated where the addition is attached to the existing building.

4 Features of the proposed building addition.

6.8 Solar Water Heating and Space Heating

Modeling of solar water heating and space heating systems is not an optional capability for residential ACMs, but ACMs must provide an input for the energy provided by solar or other nondepletable sources. These inputs are described in Chapter ~~2~~4.

The Commission has approved the use of various versions of the f-Chart program for analyzing active solar systems. These programs may be used to estimate the energy credit to enter in the ACM. Guidelines for the use of f-Chart are included in Chapter 7 of the *Residential Manual*.

This Manual does not address approval of solar analysis programs. The application package for approval of solar water heating and space conditioning programs is included as Appendix G.

When a credit is taken for nondepletable energy, the ACM standard input reports must flag this and include a statement in the *Special Features and Modeling Assumptions* section of the reports. The ACM user must also attach supporting calculations or worksheets of Commission approved methods.

6.9 Form 3 Report Generator

This test requires that ACMs correctly calculate the U-value of several construction assemblies. These construction assemblies are shown in Appendix E. The Form 3 generator must produce the values indicated in Table 6-10 for U-value. Construction assembly U-values must be calculated in a manner consistent with the manner and examples shown in the *Residential Manual*, in the glossary under "R-value" and "U-value", and in Appendix E.

Table 6-10 - Form 3 Generator Results

Construction Assembly Code	U-value
W.19.2x6.16	.065
R.38.2x4.24	.025
R.22.2x4.24	.041
RP.22.2x6.48	.044
FC.30.2x10.16	.028
FX.30.2x10.16	.034

6.10 Exceptional Methods Which May Be Approved In The Future

The Commission may approve additional Exceptional Methods in the future, for instance, additional water heating credits. All approved ACMs must provide an input for space heating, space cooling and water heating systems to allow the user to enter a value for these possible credits. The ACM standard reports identify all non-zero values and place a statement in the *Special Features and Modeling Assumptions* section of the standard reports. The ACM user must include supporting calculations, worksheets or equipment specifications with the building permit application.